Ontario Small Town and Rural Development (OSTAR) Infrastructure Program

Round 1: Public Health and Safety

Option 2 Projects:
Public Health and Safety

Preparing Terms of Reference for:

Water Efficiency/Distribution Optimization Studies;
Sewage Collection System Optimization Studies;
Water Treatment Plant Optimization Studies;
Wastewater Treatment Plant Optimization Studies; and

Engineering Study Reports, including:

Communal Sewage System Studies;
Private Sewage System Studies;
Communal Water System Studies; and
Private Water System Studies.

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INTRODUCTION

The purpose of the SuperBuild OSTAR Infrastructure Program is to improve the quality of infrastructure in Ontario's small towns, rural communities, and small cities. SuperBuild's objectives for OSTAR include:

- Addressing infrastructure investment needs, including health and safety priorities;
- Investing in strategic infrastructure projects that support rural and urban economic development;
- Finding new and better ways to finance and deliver infrastructure, including greater use of public-private partnerships; and,
- Improving infrastructure planning and management.

The Terms of Reference apply to Option 2 projects as it is directed towards addressing public health and safety priorities with municipal water and sewage infrastructure.

Applicants requesting funding for assistance for projects to solve their top public health and safety priority with municipal water or sewage infrastructure are required to investigate and commit to a cost effective solution. Environmental studies to identify such a solution are supported under the OSTAR program. Depending on specific circumstances, applicants should undertake the following:

> Investigate and report on the feasibility of using neighbouring municipal infrastructure, including area/joint servicing schemes, as a cost effective option to constructing separate treatment facilities to resolve serious public health or safety concerns.
>
> Investigate and report on the nature of the problem, past practices and potential efficiency and system optimization improvements to mitigate or eliminate the problem. Performance objectives and a business case will form part of each study to document how economic and environmental objectives will be achieved at least cost.

Applicants should target one or a combination of the following key areas: water conservation and efficiency, optimization of water works, optimization of sewage works[1].

A major goal of the OSTAR program is to facilitate the investigation and implementation of cost effective solutions to address public health and safety priorities. Where a municipal capital works project may be required, these works must be planned in accordance with the procedures and study requirements of the Municipal Engineers Association (MEA) Class Environmental Assessment (EA) for Water and Wastewater Projects (June 1993).

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1 Water works refer to any works for the collection, production, treatment, storage, supply and distribution of water. Sewage works refer to any works for the collection, transmission, treatment and disposal of sewage. Works on private property on a communal project are normally excluded from the definitions for water and sewage works.

Municipalities are encouraged to use these terms of reference as a guide when developing their own terms of reference for a study/project. **The identified problem must include sufficient information and supporting details to demonstrate that there is a public health and safety problem that exists and must be resolved.**

REVIEW OF COST EFFECTIVE ALTERNATIVES

All studies must investigate alternatives including the following to ensure that the goals of OSTAR are met:

A) Efficiency and optimization

Water efficiency

Water efficiency refers to a beneficial reduction in water consumption, seasonal and maximum daily demands and the attendant waste water flows. Where water efficiency is not sufficient in itself to solve the public health and safety related problem, water efficiency should be combined with the preferred solution to eliminate, reduce, or defer the need to expand water and sewage works.

System optimization

The purpose of an optimization study is to identify cost effective opportunities to optimize the use and functioning of the community's existing water/sewage infrastructure so as to eliminate, public health and safety risks.

B) Area joint servicing arrangements

Area-wide servicing schemes have the potential for avoiding new capital investment and for maximizing the return on existing capital investments. For the purposes of this program, area joint servicing is defined as a partnership involving two or more municipalities sharing water or sewage facilities.

As part of alternative solutions and early in the planning process, municipalities must investigate the feasibility of using a neighboring municipal infrastructure as a cost effective solution to resolving a servicing issue.

The study documentation must confirm, as a minimum, that the municipal council has communicated with neighboring municipalities to discuss the possibility of undertaking a joint servicing scheme.

C) Private services

Where existing dwellings are on private services, the applicant must include in the proposed study, upgrade of the private services as an alternative to constructing a communal system. The establishment and/or upgrading of existing private systems has the potential to provide cost effective opportunities to conserve and protect sources of water while at the same time reducing, eliminating, or deferring the

need to establish or expand communal works. Where the upgrading of existing private systems would eliminate public health and safety problems, it may be selected as the preferred solution.

Cost evaluations

The cost of implementing the solution addressing the public health and safety problem must be determined. The preferred option should satisfy natural, economic social requirements and produce the desired result for the least cost. The basis for the determination of costs must allow for a meaningful comparison of all the alternatives considered.

The determination of the cost of an option must be made on the basis of amortized gross capital cost plus operation and maintenance costs. The options for the choice of amortization period include the expected life of the facility or a set period. The choice of amortization period must be justified. Operating costs must include all labor, overhead and consumable materials. Maintenance costs must include provisions for day-to-day requirements plus the costs associated with capital replacement.

For amortization calculations, municipality must use current interest and inflation rates.

The study must identify financing options for implementation of the preferred alternative (e.g. development charges, taxes, sewer rate etc). Municipalities must not rely on financing their project through grants from the province, although, provincial grants may be considered as an option.

MEA CLASS EA REQUIREMENTS

Where a municipal water, sewage or stormwater management capital works project may be the preferred solution, the planning and design must be undertaken in accordance with the procedures and study requirements of the Municipal Engineers Association (MEA) Class Environmental Assessment (EA) for Water and Wastewater Projects.

The MEA Class EA for Municipal Water and Wastewater Projects outlines a decision-making procedure for municipalities and designated private sector proponents to plan and undertake all municipal sewage, stormwater management and water projects. The Class EA requires the evaluation of the environmental effects of alternatives solutions, alternative methods of implementing solutions and the identification of a preferred solution.

Copies of the MEA Class EA and the requirements for a municipal capital works project can be obtained for a fee from the Ontario Good Roads Association, 2-530 Otto Road, Mississauga, Ontario, L5T 2L5, (905) 795-2555, fax (905) 795-2660.

TECHNICAL STEERING COMMITTEE

For any study project a project technical steering committee should be established, consisting of representatives from the municipality, the Ministry of the Environment and the consulting engineer. Where appropriate, the committee should also include representatives of the Ministry of Natural Resources, conservation authorities and health units.

The mandate of the technical steering committee would be to oversee the project, to assist the municipality in ensuring that the terms of reference are adhered to, to provide mid-course adjustment as needed to ensure that the study goals are met, and to ensure that there is a good understanding of what study activities are eligible for financial assistance under OSTAR. The technical steering committee would provide direction to the consulting engineer on the nature and scope of assigned tasks.

FURTHER INFORMATION

For more information on OSTAR, please contact 1-866-30-OSTAR, or visit www.superbuild.gov.on.ca

OBJECTIVES

For municipalities that meet the *Drinking Water Protection Regulation (August 2000)*, the principal objective of the study is to identify current and foreseeable public health or safety problems with the Municipality's water and sewage infrastructure, where:

- Contaminants are above Maximum Acceptable Concentrations, as defined by *Ontario Drinking Water Standards*, in treated drinking water systems;
- Drinking water is contaminated at the water supply source and/or due to current treatment processes;
- Municipal sewage treatment plant discharges exceed effluent criterion specified in a Certificate of Approval and/or Ministry of the Environment policy;
- A significant number of individual septic systems are contaminating surface and/or groundwater or causing sewage to pond on the ground surface; or
- Any other Public Health and Safety concerns.

Once the potential public health or safety issues have been identified, the study should identify and provide corresponding cost estimate(s) for operational / physical / infrastructure improvements necessary to mitigate the concerns.

INSTRUCTIONS

CHOOSING THE RIGHT STUDY

It is important to ensure that the type of study proposed is appropriate for the specific conditions facing a community. Table 1 provides a matrix that illustrates a range of general problems encountered and the type of efficiency or optimization study that may be applicable. Completion of an ESR is required for any expansion or new works.

The terms of reference should describe specific issues or concerns, identify key goals and objectives for undertaking the study and identify solutions that have been investigated and delivered. The terms of reference should also include background information on existing water/sewage works, water use and sewage flows, land use and other relevant matters.

TABLE 1: MATCHING CONDITIONS WITH STUDY TYPE

CURRENT SITUATION	POTENTIAL STUDY +			
	WE*	SO*	WTO*	WWTO*
▸ problem meeting the water demand from the existing water treatment plant, or well(s), due to high water per capita usage, or significant water demands by industries or institutions.	✓			
▸ water treatment plant is at or near design capacity	✓		✓	
▸ excessive water loss in the water distribution system	✓			
▸ significant growth is anticipated in the area serviced by the water treatment plant	✓		✓	✓
▸ wastewater treatment plant is at or near capacity	✓[1]	✓[2]		✓
▸ wastewater treatment plant may not be able to meet effluent criteria or other requirements outlined in MOEE regulations, policies, procedures				✓
▸ wastewater treatment plant is required to reduce pollutant loadings due to local environmental or other conditions		✓		✓
▸ sewage overflows/bypasses at pumping station(s) and/or the wastewater treatment plant due to high water flows or excessive hydraulic load	✓	✓		✓
▸ as a precursor to a wastewater treatment plant and/or pumping station expansion or upgrade	✓	✓		✓

\+ *The specific circumstances facing a community will determine what type or combination of studies is most appropriate.*

- *WE= Water efficiency/distribution system optimization; SO= Sewage collection system optimization; WTO= Water treatment plant optimization; WWTO= Wastewater treatment plant optimization*

[1] Due to high water consumption *[2] Due to high sewage flows*

Note: This table is provided for information purposes only. Note however that only studies that address public health and safety issues will be funded under OSTAR.

ASSESSING THE COSTS AND BENEFITS

Every study should give careful attention to the benefits and costs of pursuing efficiency or optimization. This requires an analysis of economic factors, including preparation of a business case.

Benefits

A comprehensive framework for benefits assessment consists of three basic steps:

1. Identify benefits of improved treatment and delivery services.
2. Quantify those benefits in chemical/biological/physical terms (e.g. loading or concentration reduction of key quality parameters).
3. Value the benefits in monetary terms where possible.

The beneficial consequences of improved service or water quality may be quantified in terms of physical, chemical, biological and socio-economic effects. Estimates of environmental or social benefits do not, however, imply anything about the relative economic **value** of each benefit. The relative importance of benefits can be determined only by the values or weights which people attach to them.

Costs

The preferred option should satisfy natural and social requirements and produce the desired result for the least cost. The basis for the determination of costs must allow for a meaningful comparison with the alternatives considered.

One-time cost considerations are not sufficient. Costs consideration must include the on going commitments incurred through the implementation of an option. The determination of the cost of an option must be made on the basis of amortized gross capital cost plus operation and maintenance costs. The options for the choice of amortization period include the expected life of the facility or a set period. The choice of amortization period must be justified. Operating costs must include all labour, overhead and consumable materials. Maintenance costs must include provisions for day-to-day requirements plus the costs associated with capital replacement.[2]

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[2] For cost calculations, the municipality must use current interest and inflation rates.

Once the benefits and costs of efficiency or optimization have been estimated these should be compared with the relative benefits and costs of alternatives in the absence of efficiency or optimization. For example, the final report should indicate capital expenditure dollars that will be saved as a result of implementing the recommendations from the water efficiency or system optimization study.

PERFORMANCE MEASURES

Another important component of an efficiency or optimization study is developing a set of performance measures. Performance measures are tools for rating the performance or the results of a particular action or program, and can be used to guide decisions and management actions. While each community needs to develop its own specific measures, the following categories should be included:

- ✔ public health and safety objectives
  - ▸ based on legal requirements, relevant objectives specified in inter-jurisdictional agreements, approved remedial action plans and completed watershed studies
- ✔ water demand
  - ▸ current and projected, with and without, implementation of identified protection measures and technologies
- ✔ water quality and quantity
  - ▸ current and projected with, and without, implementation of identified protection measures and technologies
- ✔ economic objectives
  - ▸ identified in economic analysis and business case including a comparative analysis of the replacement of existing drinking water sources with alternate water sources

GENERAL REQUIREMENTS

1. The Report must include:

- Overall description, review and assessment of the existing system.
- Review of past records and consultations with the Municipality's Operations and neighbouring municipalities and their Operations (if applicable).
- Identification of area(s) of concern regarding the public health and safety.
- Recommendations on the preferred solution to eliminate the public health and safety risk(s).
- Assessment and recommendations on the physical Works to be carried out based on the preferred solution.
- Detailed cost estimates for the preferred solution.
- Recommendations on the monitoring regime for entire system including compliance with Regulation to mitigate future public health and safety risks.
- Compilation of Certificates of Approvals for the works.
- All mandatory certifications by The Engineer.
- The Environmental Study Report must identify a cost effective solution.

2. The problem definition for the study must clearly and concisely demonstrate a public health and safety problem with the existing water and/or sewage services.

3. Ministry of the Environment regional and/or other staff must be represented on the technical steering committee for the study project.

4. A progress report may have to be submitted to the Environmental Partnerships Branch (EPB) for review prior to the selection of the preferred alternative (Phase 2 of the MEA Class EAs). The progress report must include the status of the project, alternative solutions, the evaluation criteria and the evaluation methodology. The purpose of reviewing the progress report is to ensure cost effective options are being investigated. Payments will only be made if the reviewer(s) is satisfied with the progress of the study. Additional progress reports may be requested by EPB.

5. At the discretion of the Ministry of the Environment, the study may be subject to peer review. In such case, at the ministry's request, the applicant municipality must ensure that a peer review is conducted prior to the selection of the preferred alternative.

6. The final report will be reviewed by technical staff to ensure that the most cost effective solution is selected and to determine whether the outcome of the study is satisfactory for the purpose of funding eligibility under the OSTAR program.

Municipal Project Reference No.: _____

TERMS OF REFERENCE
NAME OF MUNICIPALITY~
NAME OF PROJECT~
PROJECT NO. ~

This terms of reference template is provided to assist applicants to be consistent with the requirements of MEA Class EA process while meeting the eligibility requirements of OSTAR for studies which examine cost effective solutions to water and/or sewage problems to address public health and safety concerns. The MEA Class EA has additional requirements which must be met, such as public consultation and opportunities to request a bump-up. Under the current MEA Class EA, there are five phases in determining the problem and identifying and implementing the preferred alternative solution.

Please note that under OSTAR, the costs of detailed design and construction of capital works are not covered by the funding allocations for studies and are not part of a study which is funded under OSTAR.

BACKGROUND

The municipality should provide a concise statement of the problem(s) the study is intended to address. The problem statement will likely be based upon previous work (e.g. water quality assessment, audit of the treatment process, service/maintenance logs and/or history of complaints) and should include (but is not restricted to):

- description of the public health or safety problem;
- boundaries of the problem area;
- affected water body(s) and/or aquifer(s);
- criteria of water quality and quantity;
- description of existing services;
- likely sources of problems; and
- nature of effects.

OBJECTIVES

The consulting engineer should undertake tasks in connection with a Class EA to plan and implement a municipal water and/or sewage project. The Class EA requires the evaluation of the environmental effects of alternative solutions to a problem and alternative methods of carrying out a solution, includes requirements for public input and expedites the environmental assessment of projects which have

manageable impacts. Specific tasks generally include: identifying the nature, cause and extent of problems; the collection, review and analyses of data; systems modelling; notification of government agencies and affected municipalities/public and interested groups and individuals about the problem(s) and alternative solutions; identification and evaluation of alternative solutions to the problem and alternative methods before determining the recommended solution; identification of potential impacts and mitigation measures; convening and participating in public information meetings for all interested groups and individuals; and confirming the preferred solution.

Studies funded under the OSTAR program, must investigate a full range of alternatives including the following:

- Water efficiency and system optimization
- Area joint servicing arrangements
- Private services

DOCUMENTATION

The documentation must provide detailed information on the problem, existing background information, evaluation of alternatives, the preferred alternative, cost analyses of all alternative solutions, and must be sufficiently detailed to permit the municipality to obtain a conditional Certificate of Approval from the Ministry of the Environment.

Where a capital works project is part of the preferred alternative, the study documentation must include consideration of the capacity of the facilities, the site of the facilities, anticipated environmental effects and possible mitigation measures.

GENERAL REQUIREMENTS

In carrying out the study, the consulting engineer should refer to the applicable section(s) of the Ministry's Guidelines for the Design of Sanitary Sewage Works, Storm Sewers (Interim), Water Distribution Systems, Water Storage Facilities, Servicing of Areas Subject to Adverse Conditions, Water Supply for Small Residential Developments, Seasonally Operated Water Supplies and the associated appendices as well as the ministry's Guidelines for the Design of Water and Sewage Treatment Works.

In addition, for the demand management portion of the study, the consulting engineer should refer to the Water Conservation Guidebook for Small and Medium-Sized Utilities (August 1993) published by the AWWA, Pacific Northwest Section (PNWS) Water Conservation Committee.

SPECIFIC TASKS

A Class EA to plan and undertake a municipal water or sewage works normally includes tasks are described in the following appendices. While the tasks may be undertaken individually, it is important that they are documented and that their results integrated into the development of the EA. The public participation program, for instance, may require that a notice be published at the time of project initiation and that there are opportunities throughout the project for input when significant project milestones are reached.

Appendices A - H provide more detailed templates for terms of reference for the studies. These templates may be modified as required to suit specific conditions within the municipality.

APPENDIX A WATER EFFICIENCY/DISTRIBUTION OPTIMIZATION STUDIES

1.0 Water and sewage system data

Gather all existing data on your water distribution and sewage collection systems for a minimum of three years. Data may include the following:

1.1 Water System

Identify:

- service area, population served, number of houses, commercial and institutional establishments serviced, daily and seasonal variations, etc.;
- historical water treatment plant flows;
- amount of water used;
- water metres in use;
- pipe material, bleeders;
- by-laws and their enforcement;
- demographics and peculiarities of the community;
- previous studies/data on water treatment and distribution system; and
- water efficiency devices/measures used in the past and their success.

1.2 Sewage system

Identify:

- type of collection system (i.e. combined, partially combined or separate);
- historical wastewater treatment plant flows;
- service area, population served, number of houses, commercial and institutional establishments serviced, etc.;
- pipe material;
- by-laws and their enforcement;
- demographics of the community; and
- cross-connections and storm overflows.

1.3 Identify any uncertainties in the water distribution system including data gaps, leakage and amount of unaccounted-for water production within the system.

1.4 Identify demand characteristics of the water supply system.

1.5 Forecast future anticipated water demand.

1.6 Identify and obtain all previous reports/data on the sewage collection and treatment system.

1.7 Obtain maintenance and repair records for the sewage collection system.

2.0 Water and sewage system flow evaluation

2.1 Calculate design flows for the existing sewage collection and water distribution systems and compare with actual flows. For example:

- If water consumption is significantly high, then the municipality should concentrate on a Water Efficiency/Distribution System Optimization Study to identify opportunities to reduce water consumption.

- If the purpose of conducting the Water Efficiency/Distribution System Optimization Study is to reduce excessive sewage flows, and water consumption is low in relation to the sewage flows, then a Sewage Collection System Optimization Study may be required to identify opportunities to reduce extraneous flows to the sewage collection system.

2.2 Review all previous reports/data to determine the studies/works that have been performed in the past and the existing condition of the water distribution system.

2.3 Review maintenance and repair records to determine the past deficiencies of the water distribution system and the type of problems that occurred in the past.

2.4 Identify/estimate the reduction in water supply as a result of implementing water efficiency measures recommended or proposed but not yet implemented.

2.5 Liaise with the Ministry of the Environment where applicable. For example, where the efficiency/optimization of industrial users are of concern, contact should be made with the Industry Conservation Branch.

3.0 Water efficiency measures

Consider the following efficiency measures:

3.1 Municipal

- installing water metres (residential, commercial, institutional and industrial)
- cost recovery water pricing policies
- public information on water efficiency
- water system audits
- leak detection surveys of water mains and repair program
- incentive programs to customers to implement efficiency measures
- regulations

3.2 Residential

- six litre/flush toilets
- low flow showerheads and faucets

- leak repair kit
- water-efficient appliances
- residential fixture retrofit kits
- water audits
- information campaigns
- lawn-water guides
- low water-use plants
- low water-use landscaping
- elimination/reduction of bleeders
- freezing prevention devices
- insulation of hot water tanks/pipes

3.3 Commercial/institutional

- same activities as above
- educating water users
- water recycling/reuse
- landscape irrigation audits
- process changes
- water efficient cooling systems and air conditions

3.4 Industrial

- same activities as above
- eliminating water waste
- optimizing flow rates
- recycling process water

4.0 Water distribution system investigation

4.1 Conduct a leak detection survey of the water distribution system.

4.2 Analyse hydraulic flows at water supply points and establish low flows, peak flows and seasonal variations.

4.3 Determine variations in pressure within the water distribution system (including potential storage requirements).

5.0 Data evaluation and design of efficiency program

5.1 Evaluate all survey data.

5.2 Provide for public involvement (e.g. open house) in the design of the water efficiency program. Effective water efficiency initiatives are going to require the involvement of water users. An advisory committee should be formed to offer advice and feedback as the program is developed.

5.3 Establish water efficiency goals and performance measures which define precise objectives for

undertaking efficiency initiatives in the community. The objectives should be quantified.

5.4 Review water efficiency alternatives and assess these costs and benefits of implementing specific technologies/actions.

5.5 Estimate the reduction in water flows and water quality improvements by implementing the identified technologies/actions.

5.6 Review the existing bylaws, their enforcement and determine the need for improvements.

5.7 Review and evaluate the municipality's existing maintenance program, and determine the need for improvement.

5.8 Undertake an analysis of the benefits to the community of implementing water efficiency.

6.0 Recommendations

6.1 Highlight cost effective technologies/actions which will achieve the identified objectives.

6.2 Prepare a business case for implementing the proposed technologies/actions.

6.3 Develop a correction program along with estimated costs.

6.4 Specify performance measures.

6.5 Prepare a written report documenting the information gathered and the analyses undertaken. The report should be submitted to all technical committee members for comments/approval and identification of follow up activities.

7.0 Implementation

7.1 Monitor the implementation of the program and assess its effectiveness against the identified performance measures.

7.2 Make the necessary corrections to achieve the study objectives.

APPENDIX B SEWAGE COLLECTION SYSTEM OPTIMIZATION STUDIES

1.0 Water and sewage system data

Gather all existing data on your water distribution and sewage collection systems for a minimum of three years. Data may include the following:

1.1 Water system

Identify:

- service area, population served, number of houses, commercial and institutional establishments serviced, daily and seasonal variations, etc.
- historical water treatment plant flows
- amount of water used
- water metres in use
- pipe material, bleeders
- bylaws and their enforcement
- demographics and peculiarities of the community
- previous studies/data on water treatment and distribution system
- water efficiency devices/measures used in the past and their success

1.2 Sewage System

Identify:

- type of collection system (i.e. combined, partially combined or separate)
- historical wastewater treatment plant flows
- historical pumping station(s) flows
- service area, population served, number of houses, commercial and institutional establishments serviced, etc.
- historical data on dry and wet weather flows at the pumping station(s) and the wastewater treatment plant, and seasonal variations, etc.
- occurrences and volume of overflows/bypasses
- bylaws and their enforcement
- cross-connections and storm overflows

1.3 Identify any illegal connection such as roof leaders, weeping tiles, foundation drains, sump pumps, catch basins, surface drains, etc. connected to the sewage collection system.

1.4 Forecast future anticipated sewage flows.

1.5 Identify and obtain all previous reports/data on the sewage collection and treatment system.

1.6 Obtain maintenance and repair records for the sewage collection system.

2.0 Water and sewage system flow evaluation

2.1 Calculate design flows for the existing sewage collection and water distribution systems and compare with actual flows. For example:

- If water consumption is significantly low in relation to the sewage flows, then the municipality should concentrate on a Sewage Collection System Optimization Study to identify opportunities to reduce extraneous flows to the sewage collection system.
- If water consumption is high, then a Water Efficiency/Distribution System Optimization Study may identify further opportunities to reduce the flow of wastewater to the sewage collection system.

2.2 Review all previous reports/data to determine the studies/works that have been performed in the past and the existing condition of the sewage collection system.

2.3 Review maintenance and repair records to determine the past deficiencies of the sewage collection system and the type of problems that occurred in the past.

2.4 Identify areas (on the private and public side) that have excessive flows (i.e. inflow/infiltration) entering the sewage collection system.

2.5 Identify/estimate the reduction in sewage flows as a result of implementing water efficiency measures recommended or proposed but not yet implemented.

2.6 Liaise with the Ministry of the Environment where applicable. For example, where the efficiency/optimization of industrial users are of concern, contact should be made with the Industry Conservation Branch.

3.0 Sewage collection system investigation

3.1 Analyse the historical and monitored flow data at the pumping station(s) and the wastewater treatment plant for each drainage area, establishing actual dry weather and wet weather flows.

3.2 Establish groundwater level variations for each drainage area.

3.3 Conduct a more detailed analysis in the drainage areas with the highest extraneous flows.

3.4 Identify the sewage overflow/bypassing locations and determine the frequency, volume and cause of the overflow/bypass.

3.5 Conduct a visual inspection of major pumping stations to identify structural and equipment condition, stand-by power and other critical features.

3.6 Interview the collection system operating staff to identify operating procedures and key issues,

such as known problem areas.

3.7 Establish a public awareness program prior to undertaking a house-to-house survey.

3.8 Conduct a house-to-house survey/smoke testing to determine individual sources of extraneous flow from roof leaders, weeping tiles, foundation drains, sump pumps, catch basins, surface drains, etc. connected to the sewage collection system.

3.9 Conduct, as necessary, a closed circuit television inspection survey of suspect lengths of sanitary sewer, including service connections, for infiltration and structural deficiencies.

4.0 Data evaluation and design of optimization program

4.1 Evaluate all survey data.

4.2 Determine the hydraulic capacity of the sewage pumping station(s) and sewage collection system.

4.3 Identify specific deficiencies of the sewage collection system (including the private side) and potential solutions.

4.4 Identify/estimate, based on the survey data, the contribution (hydraulically) of all extraneous flows (on the public and private side) entering the sewage collection system.

4.5 For combined sewer systems, identify/estimate the reduction in sewage flows by separating the systems.

4.6 Establish optimization goals and performance measures which define precise objectives for undertaking optimization technologies/actions. The objectives should be quantified.

4.7 Review optimization alternatives and assess costs and benefits of specific technologies/actions.

4.8 Identify/estimate the reduction in sewage flows by implementing the identified technologies/actions.

4.9 Review the existing bylaws, their enforcement and determine the need for improvements.

4.10 Review and evaluate the municipality's existing maintenance program and determine the need for improvement.

4.11 Undertake an analysis of benefits to the community of implementing sewage collection system optimization.

5.0 Recommendations

5.1 Highlight cost effective technologies/actions which will achieve the specified objectives.

5.2 Prepare a business case for implementing the proposed technologies/actions.

5.3 Develop a correction program along with estimated costs.

5.4 Specify performance measures

5.5 Prepare a written report documenting the information gathered and the analyses undertaken. The report should be submitted to all technical committee members for comments/approval and identification of follow up activities.

6.0 Implementation

6.1 Monitor the implementation of the program and assess its effectiveness against the identified performance measures.

6.2 Make the necessary corrections to achieve the study objectives.

APPENDIX C WATER TREATMENT PLANT (WTP) OPTIMIZATION STUDIES

1.0 Water treatment plant data

1.1 Obtain a copy of the certificate(s) of approval and any amendments or notices.

1.2 Gather data on raw and treated water quality for a minimum of three years.

1.3 Gather data on chemical dosage for a minimum of three years.

1.4 Gather data on residuals generation and disposal for a minimum of three years.

1.5 Gather data on average monthly flows, average daily flows, maximum daily flows, etc. for a minimum of three years.

1.6 Document the effect of seasonal changes on raw water quality and other factors on treated water quality.

1.7 Gather design and operating data for each unit process or component of the plant. Major processes or components could include: intake, screens, flow measurement and control systems, rapid mixing, flocculation basin, sedimentation basin, filters, low and high lift pumps, plant storage reservoirs, plant waste collection and treatment systems, plant instrumentation and chemical feed systems, including disinfection.

1.8 Identify the type and frequency of sampling and any uncertainties in the information.

1.9 Determine validity of the data and the information collected.

1.10 Document the operational procedures of the plant.

1.11 Obtain maintenance and repair records for the plant.

1.12 Determine the physical condition of each major component of the plant.

2.0 Data evaluation and plant performance review

2.1 Plant performance review

Optimization should include both process and design considerations. Conduct a plant performance review to identify and prioritize existing factors that may limit the performance of the plant. The major steps involved in a plant performance review include:

- initial meeting and plant tour;
- collect monitoring and design data (one year period);

- evaluate major unit processes;
- interview all plant staff and relevant management personnel;
- determine performance limitations categorized by design, operations, maintenance, administration and management; and
- present plant performance review results to plant staff and management.

2.2 Plant operation performance and process audits

If it was determined, through the plant performance review, that the plant is **mechanically capable** and no major design limitations exist, conduct a plant operation performance audit to correct the non-design limitations at the **existing** facility. The major steps involved in a plant operations performance audit include:

- estimate cost of conducting the plant operations performance audit;
- facilitate initiatives to correct performance limiting factors which are non design related;
- transfer skills to plant staff and management to achieve and continue to maintain optimum performance;
- document improved performance; and
- final meeting.

If it was determined that the plant is **not mechanically capable** and significant design limitations exist, conduct a plant process audit to correct the design limitations at the **existing** facility in order to achieve the performance objectives. The plant process audit should confirm the design limitations identified in the plant performance review and determine the requirements for upgrade and/or construction. The major steps involved in a plant process audit (not all steps are required in all cases) include:

- estimate the cost of conducting the plant process audit;
- undertake hydraulic analysis;
- undertake accuracy testing of flow metering;
- undertake data collection with on-line monitoring and automatic sampling;
- evaluate particle removal process;
- evaluate disinfection process; and
- undertake computer modelling.

After completing the plant process audit, if significant operations, maintenance, administration and/or management limitations remain, conduct a plant operations performance audit to resolve these outstanding limitations.

2.3 Establish optimization goals and performance measures which define precise objectives for undertaking optimization technologies/actions. The objectives should be quantified.

2.4 Review the optimization alternatives and determine the costs and benefits of the identified technologies/actions.

2.5 Undertake an analysis of the benefits to the community of implementing water treatment plant optimization.

3.0 Recommendations

3.1 Highlight cost effective technologies/actions which will achieve specified objectives.

3.2 Prepare a business case for implementing the proposed technologies/actions.

3.3 Specify performance measures.

3.5 Prepare a written report documenting the information gathered and the analyses undertaken. The information should identify all plant facilities and operations and should include: evaluation of plant processes, assessment of plant performance, identification of the factors limiting plant performance, evaluation of the overall plant capacity and proposed recommendations. The report should be submitted to all technical committee members for comments/approval and identification of follow up activities.

4.0 Implementation

4.1 Monitor the implementation of the program and assess its effectiveness against the identified performance measures.

4.2 Make the necessary corrections to achieve the study objectives.

APPENDIX D WASTEWATER TREATMENT PLANT (WWTP) OPTIMIZATION STUDIES

1.0 Wastewater treatment plant data

1.1 Obtain a copy of the certificate(s) of approval and any amendments or notices.

1.2 Gather data on raw wastewater characteristics and final effluent quality for a minimum of three years.

1.3 Gather data on average monthly flows, average daily flows, low flows, peak flows, number of bypasses, etc, for a minimum of three years.

1.4 Gather data on historical biosolids generation, monitoring and disposal for a minimum of three years.

1.5 Document the seasonal differences and other factors affecting the operational performance of the plant.

1.6 Gather design and operating data for each unit process or component of the plant. Major components could include: screens, grit channel, flocculation tanks, clarifiers, aeration tanks, sludge pumping, chlorination tanks and sludge digesters.

1.7 Identify the type and frequency of sampling and any uncertainties in the information.

1.8 Determine validity of the data and information collected.

1.9 Document the operational procedures of the plant.

1.10 Obtain maintenance and repair records of the plant.

1.11 Determine the physical condition of each major component of the plant.

2.0 Data evaluation and plant performance review

2.1 Plant performance review

Optimization should include both process and design considerations. Conduct a plant performance review to identify and prioritize existing factors that may limit the performance of the plant. The major steps involved in a plant performance review include:

- initial meeting and plant tour;
- collect monitoring and design data (one year period);
- evaluate major unit processes;
- interview all plant staff and relevant management personnel;
- determine performance limitations categorized by design, operations, maintenance, administration and management; and

- present plant performance review results to plant staff and management.

2.2 Plant operation performance and process audits

If it was determined, through completion of the plant performance review, that the plant is **mechanically capable** and no major design limitations exist, conduct a plant operations performance audit to correct the non-design limitations at the **existing** facility. Conduct a plant operations performance audit to correct the performance limitations identified in the plant performance review to achieve performance objectives The major steps involved in a plant operations performance audit include:

- estimate cost of conducting the plant operations performance audit;
- facilitate initiatives to correct performance limiting factors which are non design related;
- transfer skills to plant staff and management to achieve and continue to maintain optimum performance;
- document improved performance; and
- final meeting.

If it was determined that the plant is **not mechanically capable** and significant design limitations exist, conduct plant process audit to correct the design limitations at the **existing** facility in order to achieve the performance objectives. The plant process audit should confirm the design limitations identified in the plant performance review and determine the requirements for upgrade and/or construction. The major steps involved in a plant process audit (not all steps are required in all cases) include:

- estimate the cost of conducting the plant process audit;
- undertake hydraulic analysis;
- undertake accuracy testing of flow metering;
- undertake data collection with on-line monitoring and automatic sampling;
- evaluate clarifier process;
- undertake oxygen transfer testing;
- evaluate digester mixing; and
- undertake computer modelling.

After completing the plant process audit, if significant operations, maintenance, administration and/or management limitations remain, conduct a plant operations performance audit to resolve these outstanding limitations.

2.3 Liaise with the Ministry of the Environment where applicable. For example, where the efficiency/optimization of industrial users are of concern, contact should be made with the Industry Conservation Branch.

2.4 Establish optimization goals and performance measures which define precise objectives for undertaking optimization technologies/actions. The objectives should be quantified.

2.5 Review the optimization alternatives and determine the costs and benefits of identified technologies/actions

2.6 Undertake analysis of the benefits to the community of implementing wastewater treatment plant optimization.

3.0 Recommendations

3.1 Highlight cost effective technologies/actions which will achieve the specified objectives.

3.2 Prepare a business case for implementing the proposed technologies/actions.

3.3 Prepare a written report documenting the information gathered and the analyses undertaken. The information should identify all plant facilities and operation and should include: evaluation of plant processes, assessment of plant performance, identification of the factors limiting plant performance, evaluation of overall plant capacity and proposed recommendations. The report should be submitted to all technical committee members for comments/approval and identification of follow up activities.

4.0 Implementation

4.1 Monitor implementation of the program and assess its effectiveness against identified performance measures.

4.2 Make the necessary corrections to achieve the study objectives.

APPENDIX E COMMUNAL SEWAGE SYSTEM STUDIES (Including ESRs)

1. Establish study boundaries

This includes the preparation of basic map(s) to delineate the boundaries (geographical, hydrological, political and others) and to document the features of the study area. The map should include:

- description of existing services including private systems;
- land use data, including residential, institutional, commercial, industrial and agricultural activity;
- location of private sewage treatment systems and communal storm, combined and sanitary sewerage facilities, pumping stations and treatment facilities;
- location of stormwater management facility outfalls, combined sewer overflows, pumping station bypasses and sewage treatment plant outfalls;
- location of water sources, recreational water use areas (beaches) and receiving water(s);
- location of groundwater recharge and discharge areas, environmentally sensitive areas and areas of natural and scientific interest.

If considering private system upgrades as part of the study, please refer to Appendix F - Private Sewage Systems for additional information.

2. Identify the nature and sources of the problem

- Review all relevant available reports and data.
- Identify incidences of private treatment system failures (i.e. surface ponding), basement flooding, overflows, bypasses, poor effluent quality, and effects on receiving water.
- Identify municipal and industrial pollution sources both qualitatively and quantitatively. These include water use rates, inflow and infiltration, overflows, bypasses, treatment plant effluent, industrial discharges, etc.
- Identify potential upstream or out-of-area contributors that could affect the area and downstream users that may be affected by discharges in the study area.

3. Define the extent of the problem

Modelling and analysis of the sewerage system should be carried out as necessary to assess the sources of flows, effectiveness of treatment processes and effects on receiving waters.

In general, the analysis will consist of compiling and interpreting existing data to:

- describe the physical and hydraulic characteristics of the collection system and treatment systems;
- determine existing effluent quality;
- determine the magnitude of hydraulic and pollutant loads to the receiving waters;
- determine the effect of the hydraulic and pollutant loads on the receiving waters.

4. Carry out an analysis of existing facilities

Modelling and/or analysis of existing facilities are necessary to integrate municipal service planning and operation with water quality management.

Analysis of facilities is required to:

- review the effect of septic tanks in the study area;
- assess the hydraulic adequacy of sanitary and combined sewers, storage, treatment and pumping facilities and assess the performance of treatment facilities under present and future land use conditions;
- review basement flooding, surcharging and excessive infiltration in sanitary or combined sewer areas;
- identify potential rehabilitation and upgrading of collection and treatment systems or expansion alternatives;
- review the operation of the treatment and collection system and maintenance practices to identify opportunities for implementing more cost effective practices;
- determine the relative significance of the limitations and characteristics identified.

Methods and levels of detail of the analysis should be commensurate with the intended purposes of the analysis and the inherent physical characteristic of the facilities.

5. Establish a public participation program

A public participation program is required to:

- meet the requirements of the MEA Class EA;
- inform the public of the issue(s) and problem(s) related to the study area;
- provide the public with an opportunity to participate in the decision-making process.

The program may consist of public meetings, the establishment of a public advisory committee and questionnaires to obtain public input.

6. Identify and evaluate alternative solutions

All alternatives including area joint servicing arrangements, water efficiency, system optimization and private services, must be investigated and documented.

- Formulate performance criteria for water demand management, collection system and pumping station(s) operation (flow, storage) and treatment facility operation (treatment rates, effluent quality). Obtain comments on the criteria from the appropriate provincial, municipal and public agencies.

- Establish an evaluation process which takes the natural, social and economic requirements into consideration and obtain comments on the process from the appropriate provincial, municipal and public agencies. Model and analyse the alternative solutions to determine their ability to meet the performance criteria.

- Consider the net effect of alternatives on pollutant loadings. For example, where a combined

sewer separation program is evaluated, loadings before and after separation must be considered. This would require that loadings from the sanitary system post separation as well as the increased loadings from the storm system be determined to establish if there is any net effect on the environment.

- Conduct a feasibility analysis of alternative remedial measures and quantify the expected improvement, for example, reduction in water use, reduction of overflow volume and/or frequency, reduction of pollutant loading, etc.

- Conduct a cost analysis of the feasible alternatives. Determine amortized capital, operation and maintenance costs. Establish the life-cycle costs of the alternatives. Comment on factors affecting the municipality's ability to pay for the implementation and operation of the alternatives.

The study may be subject to peer review. In such case, at the ministry's request, the applicant municipality must conduct a peer review. Peer review may be initiated prior to the selection of the preferred alternative.

7. Identify the preferred alternative solution and develop an implementation program

Identify the preferred alternative solution on the basis of the evaluation criteria and submit a proposed implementation program for the preferred alternative. The preferred alternative may be a combination of various solutions such as water efficiency/plant expansion, plant optimization/expansion, etc.

The program should include phasing, staffing needs, cash flow requirements and benefits expected from the implementation of the preferred alternative. The program information should be detailed for each phase of the implementation program.

8. Evaluate alternative methods for the implementation of the preferred solution

Evaluate the possible design concepts which might be utilized to implement the preferred solution. For example, if storage of peak flows for treatment in off-peak hours was identified as the preferred solution, this could involve the identification of sites and configurations for storage tanks or the evaluation of the use of oversize sewers or tunnels. Note that this task does not include the preparation of the detailed design of the preferred solution.

- Identify alternatives for the implementation of the preferred solution.
- Inventory the natural, social and economic components of the environment to the extent necessary to permit the selection of the preferred design.
- Identify the effect of the alternatives for the implementation of the preferred solution and measures to mitigate the effects.

9. Project documentation / environmental study report

In general, the planning process must be documented and must include the following:

- data collection, a description of the problem and other background information;
- evaluation of alternative solutions including the most cost effective alternative;

- the rationale employed in selecting the preferred solution to the problem;
- a comparative evaluation of the alternatives considered including the alternative solution;
- a description of the environmental considerations and effects;
- mitigating measures which will be undertaken to minimize environmental effects;
- a description of the public consultation process and an explanation of how concerns raised by the public have been addressed;
- a description of the monitoring program which will be carried out during construction and/or for a specific time during the operation or implementation of the preferred alternative, including details of the ways in which results will be communicated to the public and review agencies.

The final report should comply with the MEA Class EA and is subject to the requirements of OSTAR.

APPENDIX F PRIVATE SEWAGE SYSTEM STUDIES (Including ESRs)

1. Establish study boundaries

This includes the preparation of basic map(s) to delineate the boundaries (geographical, hydrological, political and others) and to document the features of the study area. The map should include:

- a description of the existing services.
- land use data, including residential, institutional, commercial, industrial and agricultural activity.
- location of private sewage treatment systems and communal storm, combined and sanitary sewerage facilities, pumping stations and treatment facilities.
- location of stormwater management facility outfalls, combined sewer overflows, pumping station bypasses, and sewage treatment plant outfalls;
- location of water sources, recreational water use areas (beaches) and receiving water(s);.
- location of groundwater recharge and discharge areas, environmentally sensitive areas and areas of natural and scientific interest.

2. Identify the nature and sources of the problem

- Review all relevant available reports and data.
- Identify incidences of private treatment system failures (i.e. surface ponding) and effects on receiving water(s).
- Identify municipal and industrial pollution sources both qualitatively and quantitatively. These include water use rates, effluent characteristics, etc.
- Identify potential upstream or out-of-area contributors that could affect the area and downstream users that may be affected by discharges in the study area.

3. Define the extent of the problem

Modelling and/or analysis of the sewage systems should be carried out as necessary to assess the sources of flows, effectiveness of treatment processes and effects on receiving waters.

In general, the analysis will consist of compiling and interpreting existing data to:

- describe the physical and hydraulic characteristics of the treatment systems;
- determine existing performance and effluent quality;
- determine the extent of hydraulic failures and pollutant loads to the receiving waters;
- determine the effect of the hydraulic failures and pollutant loads on the receiving waters.

4. Carry out an analysis of the area hydrogeology and existing facilities

Modelling and/or analysis of the area hydrogeology and of the existing facilities is necessary to determine if private system construction, replacement or upgrading is technically feasible and to integrate municipal service planning and operation with water quality management.

Analysis is required to:

- assess local conditions including soils, topography, sub-surface flow regime and seasonal fluctuations in the elevation of the water table;
- determine the presence of underlying aquifer(s) and areas such as sand or gravel conducive to groundwater flow or areas such as clay or rock which would impede groundwater flow;
- review the affect of septic tanks in the study area;
- identify potential rehabilitation and upgrading of treatment systems or expansion alternatives;
- review the operation of the treatment system and the maintenance practices to identify opportunities to improve performance;
- determine the relative significance of the limitations and characteristics identified.

Methods and levels of detail of analysis should be commensurate with the intended purposes of the analysis and the inherent physical characteristic of the facilities.

5. Establish a public participation program

A public participation program is required to:

- meet the requirements of the MEA Class EA;
- inform the public of the issue(s) and problem(s) related to the study area;
- provide the public with an opportunity to participate in the decision-making process.

The program may consist of public meetings, the establishment of a public advisory committee and questionnaires to obtain public input.

6. Identify and evaluate alternative solutions

All alternatives including private services, area-joint servicing arrangements, water efficiency and system optimization, must be investigated and documented.

Formulate performance criteria including criterion for water demand management. Obtain comments on the criteria from the appropriate provincial, municipal and public agencies.

Establish an evaluation process which takes natural, social and economic requirements into consideration and obtain comments on the process from the appropriate provincial, municipal and public agencies. Model and analyse alternative solutions to determine their ability to meet the performance criteria.

Conduct a feasibility analysis of alternative remedial measures and quantify the expected improvement, (for example, reduction in water use, reduction of frequency of hydraulic failure, reduction of groundwater contamination, reduction of pollutant loading, etc.).

Conduct a cost analysis of the feasible alternatives. Determine amortized capital, operation and maintenance costs. Establish the life-cycle costs of the alternatives. Comment on factors affecting the resident's and/or municipality's ability to pay for the implementation and operation of each alternative.

The study may be subject to peer review. In such case, at the ministry's request, the applicant municipality must conduct a peer review. Peer review may be initiated prior to the selection of the preferred alternative.

7. Identify the preferred alternative and develop an implementation program

Identify the preferred alternative solution on the basis of the evaluation criteria and submit a proposed implementation program for the preferred alternative. The preferred alternative may be a combination of various solutions such as water efficiency/plant expansion, plant optimization/expansion, etc.

The program will include phasing, staffing needs, cash flow requirements and expected benefits of the preferred alternative. The program information should be detailed for each phase of the implementation program.

8. Evaluate alternative methods for the implementation of the preferred solution

Evaluate the possible design concepts which might be utilized to implement the preferred solution. For example, if renewal/replacement of existing systems hours was identified as the preferred solution, this could involve the identification of sites and configurations for septic tanks and tile beds. Note that this task does not include the preparation of the detailed design of the preferred solution.

- Identify alternatives for the implementation of the preferred solution.
- Inventory the natural, social and economic components of the environment to the extent necessary to permit the selection of the preferred design.
- Identify the effect of the alternatives for the implementation of the preferred solution and measures to mitigate the effects.

9. Project documentation / environmental study report

In general, the planning process must be documented and include the following:

- data collection, a description of the problem and other background information;
- evaluation of alternative solutions including the most cost effective alternative;
- the rationale employed in selecting the preferred solution to the problem;
- a comparative evaluation of the alternatives considered including the preferred solution;
- a description of the environmental considerations and effects;
- mitigating measures which will be undertaken to minimize environmental effects;
- a description of the public consultation process and an explanation of how concerns raised by the public have been addressed;
- a description of the monitoring program which will be carried out during construction and/or for a specific time during operation or implementation of the preferred alternative, including details of the ways in which results will be communicated to the public and review agencies.

The final report should comply with the MEA Class EA and is subject to the requirements of OSTAR.

APPENDIX G COMMUNAL WATER SYSTEM STUDIES (Including ESRs)

1. Establish study boundaries

This includes the preparation of basic map(s) to delineate the boundaries (geographical, hydrological, political and others) and to document the features of the study area. The map should include:

- a description of existing services, including private systems;
- land use data, including residential, institutional, commercial, industrial and agricultural activity;
- location of water treatment and distribution facilities, private water supply systems, private sewage treatment systems and communal storm, combined and sanitary sewerage facilities, pumping stations and treatment facilities;
- location of water treatment facility backwash outfalls, stormwater management facility outfalls, combined sewer overflows, pumping station bypasses, and sewage treatment plant outfalls;
- location of water sources, recreational water use areas (beaches) and receiving water(s);
- location of groundwater recharge and discharge areas, environmentally sensitive areas and areas of natural and scientific interest.

2. Identify the nature and sources of the problem

- Review all relevant available reports and data.
- Identify incidences of water quality, quantity, and pressure related problems.
- Identify municipal and industrial water use rates both qualitatively and quantitatively.
- Identify potential upstream or out-of-area water users that could affect on the area and downstream users that may be affected by water use in the study area.

3. Define the extent of the problem

Modelling and analysis of the water supply system should be carried out as necessary to assess the sources, effectiveness of treatment processes, effects of backwash on receiving waters, flows and pressures .

In general, the analysis will consist of compiling and interpreting existing data to:

- describe the hydrogeological, physical and hydraulic characteristics of the water supply, treatment and distribution systems;
- determine existing water quality;
- determine the magnitude of use, demand, contamination and pressures;
- determine the effect of the use, demand, contamination and pressures.

4. Carry out an analysis of existing facilities

Modelling and analysis of existing facilities are necessary to integrate municipal service

planning and operation with water management.

Facilities analysis is required to:

- review the potential effect of water efficiency measures;
- review the potential effect of water system optimization measures;
- assess the hydraulic adequacy of water treatment and distribution facilities under present and future land use conditions;
- review the condition of the distribution system and assess losses from the system;
- identify potential rehabilitation and upgrading of treatment and distribution systems or expansion alternatives;
- review the operation of the treatment and distribution system and the maintenance practices to identify opportunities to implement more cost effective practices;
- determine the relative significance of the limitations and characteristics identified.

Methods and levels of detail of analysis should be commensurate with the intended purposes of the analysis and the inherent physical characteristic of the facilities.

5. Establish a public participation program

A public participation program is required to:

- meet the requirements of the MEA Class EA;
- inform the public of the issue(s) and problem(s) related to the study area;
- provide the public with an opportunity to participate in the decision-making process.

The program may consist of public meetings, the establishment of a public advisory committee and questionnaires to obtain public input.

6. Identify and evaluate alternative solutions

All alternatives including area-joint servicing arrangements, water efficiency, system optimization and private services, must be investigated and documented.

Formulate performance criteria for management of water demand, operation of the treatment facility(ies) (treatment rates, water quality), and operation distribution system(s) (storage, flow, pressure). Obtain comments on the criteria from the appropriate provincial, municipal and public agencies.

Establish an evaluation process which takes natural, social and economic requirements into consideration and obtain comments on the process from the appropriate provincial, municipal and public agencies. Model and analyse alternative solutions to determine their ability to meet the performance criteria.

The net effect of alternatives must be considered. For example, when the establishment of a communal water system is evaluated, the effect on current sewage treatment capability must be considered. This would require that loadings to the sanitary system post construction be determined to establish if there is any environmental effect.

Conduct a feasibility analysis of alternative remedial measures and quantify the expected improvement (for example, reduction in water use, reduction of the frequency of low system pressures, reduction of pollutant contamination, etc.).

Conduct a cost analysis of the feasible alternatives. Determine amortized capital, operation and maintenance costs. Establish the life-cycle costs of the alternatives. Comment on factors affecting the resident's and/or municipality's ability to pay for the implementation and operation of the alternative.

The study may be subject to peer review. In such case, at the ministry's request, the applicant municipality must conduct a peer review. Peer review may be initiated prior to the selection of the preferred alternative.

7. Identify the preferred alternative and develop an implementation program

Identify the preferred alternative solution on the basis of the evaluation criteria and submit a proposed implementation program for the preferred alternative. The preferred alternative may be a combination of various solutions such as water efficiency/plant expansion, plant optimization/expansion, etc.

The program will include phasing, staffing needs, cash flow requirements and expected benefits of the preferred alternative. The program information should be detailed for each phase of the implementation program.

8. Evaluate alternative methods for the implementation of the preferred solution

Evaluate the possible design concepts which might be utilized to implement the preferred solution. For example, if storage of treated water to meet demand during peak hours was identified as the preferred solution, this could involve the identification of sites and configurations for storage tanks. Note that this task does not include the preparation of the detailed design of the preferred solution.

- Identify alternatives for the implementation of the preferred solution.
- Inventory the natural, social and economic components of the environment to the extent necessary to permit the selection of the preferred design.
- Identify the effect of the alternatives for the implementation of the preferred solution and measures to mitigate the effects.

9. Project documentation / environmental study report

In general, the planning process must be documented and include the following:

- data collection, a description of the problem and other background information;
- evaluation of alternative solutions including the most cost effective alternative;
- the rationale employed in selecting the preferred solution to the problem;
- a comparative evaluation of the alternatives considered including the preferred solution;
- a description of the environmental considerations and effects;
- mitigating measures which will be undertaken to minimize environmental effects;
- a description of the public consultation process and an explanation of how concerns raised by

the public have been addressed;

- a description of the monitoring program which will be carried out during construction and/or for a specific time during operation or implementation of the preferred alternative, including details of the ways in which results will be communicated to the public and review agencies.

The final report should comply with the MEA Class EA and is subject to the requirements of OSTAR.

APPENDIX H PRIVATE WATER SYSTEM STUDIES (Including ESRs)

1. Establish study boundaries

This includes the preparation of basic map(s) to delineate the boundaries (geographical, hydrological, political and others) and to document the features of the study area. The map should include:

- a description of the existing services;
- land use data, including residential, institutional, commercial, industrial and agricultural activity;
- location of water treatment and distribution facilities, private water supply systems, private sewage treatment systems and communal storm, combined and sanitary sewerage facilities, pumping stations and treatment facilities;
- location of water treatment facility backwash outfalls, stormwater management facility outfalls, combined sewer overflows, pumping station bypasses, and sewage treatment plant outfalls;
- location of water sources, recreational water use areas (beaches) and receiving water(s);
- location of groundwater recharge and discharge areas, environmentally sensitive areas and areas of natural and scientific interest.

2. Identify the nature and sources of the problem

- Review all relevant available reports and data.
- Identify incidences of water quality, quantity and pressure related problems.
- Identify municipal and industrial water use rates both qualitatively and quantitatively.
- Identify potential upstream or out-of-area water users that could affect the area and downstream users that may be affected by water use in the study area.

3. Define the extent of the problem

Modelling and analysis of the existing water services should be carried out as necessary to assess the sources, effects of water taking on surface waters and aquifers, effectiveness of treatment processes, flows and pressures .

In general, the analysis will consist of compiling and interpreting existing data to:

- describe the hydrogeological, physical and hydraulic characteristics of the water supply, treatment and distribution systems;
- determine existing water quality;
- determine the magnitude of use, demand, contamination and pressures;
- determine the effect of the use, demand, contamination and pressures.

4. Carry out an analysis of the area hydrogeology and existing facilities

Modelling and analysis of the existing facilities is necessary to integrate municipal service

planning and operation with water management.

Where applicable analysis is required to:

- review the potential effect of water efficiency measures;
- review the potential effects of water system optimization measures;
- assess local conditions, including soils, topography, subsurface flow regime and seasonal fluctuations in the elevation of the water table;
- determine the presence of underlying aquifer(s) and areas such as sand or gravel conducive to groundwater flow areas such as clay or rock which would impede groundwater flow;
- if applicable, identify potential rehabilitation and upgrading through the use of treatment systems or expansion alternatives;
- if applicable, assess the hydraulic adequacy of water treatment and distribution facilities under present and future land use conditions;
- if applicable, review the condition of distribution system and assess losses;
- if applicable, review the operation of treatment and distribution systems and maintenance practices to identify opportunities to implement more cost effective practices;
- determine the relative significance of the limitations and characteristics identified.

Methods and levels of detail of analysis should be commensurate with the intended purposes of the analysis and the inherent physical characteristic of the facilities.

5. Establish a public participation program

A public participation program is required to:

- meet the requirements of the MEA Class EA;
- inform the public of the issue(s) and problem(s) related to the study area;
- provide the public with an opportunity to participate in the decision-making process.

The program may consist of public meetings, the establishment of a public advisory committee and questionnaires to obtain public input.

6. Identify and evaluate alternative solutions

All alternatives; including private services renewal/replacement, area-joint servicing arrangements, water efficiency, and system optimization, must be investigated and documented.

Formulate performance criteria including criteria for water demand management. Obtain comments on the criteria from the appropriate provincial, municipal and public agencies.

Establish an evaluation process which takes natural, social and economic requirements into consideration and obtain comments on the process from the appropriate provincial, municipal and public agencies. Model and analyse alternative solutions to determine their ability to meet the performance criteria.

The net effect of alternatives must be considered. For example, where the establishment of a new well is evaluated, the effect on current sewage treatment capability must be considered. This would require that loadings to the sanitary system post construction be determined to

establish if there is any environmental effect.

Conduct a feasibility analysis of alternative remedial measures and quantify the expected improvement (for example, reduction in water use, reduction of the frequency of low system pressures, reduction of pollutant contamination, etc.).

Conduct a cost analysis of feasible alternatives. Determine amortized capital, operation and maintenance costs. Establish the life-cycle costs of alternatives. Comment on factors affecting the resident's and/or municipality's ability to pay for the implementation and operation of the alternatives.

The study may be subject to peer review. In such case, at the ministry's request, the applicant municipality must conduct a peer review. Peer review may be initiated prior to the selection of the preferred alternative.

7. Identify the preferred alternative and develop an implementation program

Identify the preferred alternative solution on the basis of the evaluation criteria and submit a proposed implementation program for the preferred alternative. The preferred alternative may be a combination of various solutions such as repairing, modifying or replacing an existing wells, providing treatment, relocating a sewage disposal system, etc.

The program will include phasing, staffing needs, cash flow requirements and expected benefits of the preferred alternative. The program information should be detailed for each phase of the implementation program.

8. Evaluate alternative methods for the implementation of the preferred solution

Evaluate the possible design concepts which might be utilized to implement the preferred solution. For example, if repairing, modifying or replacing existing wells was identified as the preferred solution, this could involve the identification of repair methods, modification methods and sites for the wells. Note that this task does not include the preparation of the detailed design of the preferred solution.

- Identify alternatives for the implementation of the preferred solution.
- Inventory the natural, social and economic components of the environment to the extent necessary to permit the selection of the preferred design.
- Identify the effect of the alternatives for the implementation of the preferred solution and measures to mitigate the effects.

9. Project documentation / environmental study report

In general, the planning process must be documented and include the following:

- data collection, a description of the problem and other background information;
- evaluation of alternative solutions including the most cost effective alternative;
- the rationale employed in selecting the preferred solution to the problem;
- a comparative evaluation of the alternatives considered including the preferred solution;

- a description of the environmental considerations and effects;
- mitigating measures which will be undertaken to minimize environmental effects;
- a description of the public consultation process and an explanation of how concerns raised by the public have been addressed;
- a description of the monitoring program which will be carried out during construction and/or for a specific time during operation or implementation of the preferred alternative, including details of the ways in which results will be communicated to the public and review agencies.

The final report should comply with the MEA Class EA and is subject to the requirements of OSTAR.

REFERENCES:

- MOE's *Drinking Water Protection Regulation* (August 2000).
- MOE's *Ontario Drinking Water Standards.*
- Municipal Engineers Association (MEA) *Class Environmental Assessment (EA) for Water and Wastewater Projects* (June 1993).
- MOE'S guideline on *Preparing Terms Of Reference For Water Efficiency And Sewage and Water Optimization Studies* for additional information.
- *The Ontario Composite Correction Program Manual For Optimization Of Sewage Treatment Plants* (1996).
- *Guidance Manual For Sewage Treatment Plant Liquid Train Process Audits* (1996), and *Managers' Guide To Sewage Treatment Plant Optimization* (1996).
- MOE's *Guide to Resource Conservation and Cost Savings Opportunities in the Municipal Water and Wastewater Sector* (1998).
- *Water Conservation Guidebook for Small and Medium-Sized Utilities* (August 1993) published by the AWWA, Pacific Northwest Section (PNWS) Water Conservation Committee.